English Translation of Japense patent 10134133

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]In a bar code reader which has an automatic-focusing means for switching which switches automatically a focal distance of a memory array which memorizes a bar code picturized by solid imaging means through an optical system, and a bar code and a device main frame, A bar code reader, wherein said automatic-focusing range selection means recognizes a bar code symbol from brightness information of said memory array, determines a focal distance change ratio according to a size of a bar code and performs a focal distance change.
[Claim 2]The bar code reader according to claim 1, wherein said brightness information is information on one arbitrary straight line of a memory array.
[Claim 3]The bar code reader according to claim 2 performing it after recognition of said bar code symbol stores said brightness information in arrangement one by one and changes it into width information.
[Claim 4]The bar code reader according to claim 2 performing recognition of said bar code symbol by judging whether the number of width which detects two margins beyond default value and is between margins is beyond default value.
[Claim 5]The bar code reader according to claim 2 performing recognition of said bar code symbol by detecting two margins and judging whether the number of turn of another width is even when the number of turn of one of two margins is even.
[Claim 6]The bar code reader according to claim 2 performing recognition of said bar code symbol by detecting two margins and judging whether the number of turn of another width is odd when the number of turn of one of two margins is odd.
[Claim 7]The bar code reader according to claim 2, wherein recognition of said bar code symbol detects at least two margins, considers that two margins [as / whose number of width between two margins is the maximum] are true margins and considers that width information in the meantime is a bar code symbol.
[Claim 8]In detection of said margin, Claims 4, 5, 6 and 7 determining default value from ranging information acquired by an automatic focus point means are the bar code readers of a description either.
[Claim 9]The bar code reader according to claim 2 making a decision of said focal distance change ratio according to a bias of right and left of a bar code symbol in said memory array.

[Claim 10]The bar code reader according to claim 2 making a decision of said focal distance change ratio according to the minimum width value in acquired width information.
[Claim 11]Determination of said focal distance change ratio scans said memory array in two or more straight lines, The bar code reader according to claim 2 carrying out by determining optimal focal distance change ratio if a focal distance change ratio is determined each time, it stores in arrangement and a focal distance change ratio of the last straight line is determined.
[Claim 12]The bar code reader according to claim 1, wherein said brightness information is information which stored brightness information of one arbitrary straight line of a memory array in arrangement for every arbitrary number.
[Claim 13]The bar code reader according to claim 2, wherein said automatic-focusing range selection means is an interim phase of a step number with a switchable default position of a lens of said optical system.
[Claim 14]A bar code reader with which said automatic-focusing range selection means is characterized by a default position of a lens of said optical system being a wide angle side most.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the bar code reader which has an automatic-focusing range selection device.
[0002]
[Description of the Prior Art]In recent years, many things which use solid state image pickup devices (for example, CCD, CMD, etc.) as a device which reads optical information (mainly bar code) have come to be used. The CCD-type device has an advantage of unlike a laser type, it not depending in the direction of a bar code which can read the two-dimensional bar code announced in recent years, but being able to decode.
[0003]It is also possible to change the focal distance of a lens and to change image magnification by moving a lens minutely using an actuator etc., from the place where the composition of a device (optical system) is similar to the commercial miniature camera. If this technique is used, in the imaging range of CCD, a bar code symbol will be too large, and will have overflowed, or (Refer to drawing 16), Conversely, when it cannot read by being too small (refer to drawing 17), image magnification can be changed without changing the distance of a bar code and a reader, and a bar code symbol can be picturized and decoded in a suitable size to an object image (frame memory).
[0004]As a symbol information reader which has such an automatic-focusing range selection device conventionally, a reader which is indicated by the US,5,331,176,B Description, for example is known. In this device, the lens position was adjusted and the symbol is decoded so that a square two-dimensional symbol may be included in the frame made from Lighting Sub-Division by software processing.
[0005]
[Problem(s) to be Solved by the Invention]However, in order to perform software data processing to a two-dimensional picture (frame memory) for a short time, expensive

processing units (CPU, DSP, etc.) were needed at high speed, and SUBJECT that the price of the device itself will become high occurred.
[0006]Then, the purpose of this invention solves such conventional SUBJECT, and there is in providing the bar code reader which has an automatic-focusing range selection device which can further be processed [that it is cheap and] in a short time.
[0007]
[Means for Solving the Problem]In order to solve said SUBJECT, a bar code reader of this invention, In a bar code reader which has an automatic-focusing means for switching which switches automatically a focal distance of a memory array which memorizes a bar code picturized by solid imaging means through an optical system, and a bar code and a device main frame, Said automatic-focusing range selection means recognizes a bar code symbol from brightness information of said memory array, and determines a focal distance change ratio according to a size of a bar code, and performing a focal distance change has the feature. It has the feature that said especially brightness information is information on one arbitrary straight line of a memory array.
[0008]
[Embodiment of the Invention]Hereafter, Drawings explain an embodiment of the invention in detail. Drawing 1 is a lineblock diagram of the bar code reader in which an embodiment of the invention is shown, and drawing 2 is an outline flowchart of the bar code reader of drawing 1.
[0009]This bar code reader consists of the optical system 3, CCD4, the infrared ray emitting device (henceforth IR) 5, the photosensor diode (henceforth PSD) 6, the frame memory 7 as a memory array, CPU8, the controller 12, and the lens actuator 13. CPU8 comprises the autofocus part 9, the auto zoom part 10, and the decode part 11.
[0010]First, perform initial setting (Step S1), emit light in infrared rays from IR5, and the catoptric light is detected by PSD6, It calculates in the autofocus part 9 in CPU8, the distance to a bar code reader and the barcode label 2 is measured (Step S2), a control signal is taken out to the controller 12 and the lens actuator 13 according to the result, and the focal position of the optical system 3 is adjusted. The bar code image whose focus suited will be picturized by the frame memory 7 by this the processing of a series of (Step S3).
[0011]Next, image formation of the barcode label 2 printed or stuck on the load 1 is carried out to CCD4 by the optical system 3. The label information by which photoelectric conversion was carried out is incorporated into the frame memory 7 as a video signal. If the information on the picture on the frame memory 7 is sent to the auto zoom part 10, the processing according to a picture will be made, a control signal will be again taken out to the controller 12 and the lens actuator 13 according to the result, and the focal distance of the optical system 3 will be adjusted. The barcode label 2 will be picturized by the frame memory 7 in the optimal size by this the processing of a series of (step S4).
[0012]And in the decode part 11, the decipherment based on a predetermined bar code decipherment algorithm for the barcode label 2 picturized in the optimal size is performed, and is outputted to the host device etc. which are not illustrated (Step S5).
[0013]The flow chart is written into this Description according to the recording mode of programming language C. Then, the auto zoom of step S4 in drawing 2 is explained, referring to the flow chart of drawing 3 and drawing 4.

[0014]First, the variable i is initialized to 1 (Step S41). Next, the arbitrary straight lines which carry out the virtual scan of the frame memory 7 are determined (Step S42). The operation which stores in read-out predetermined arrangement the brightness information of the pixel which a virtual scan has on the straight line one by one from the frame memory 7 is said here. In Step S42, the coordinates of a linear both-ends point may be sufficient as a linear specification method, and a slope of a line and a section may be sufficient as it. use any -- the straight line of N book is prepared beforehand (for example, the coordinates of N group are beforehand put into arrangement). Of course, what of the frame memory 7 like drawing 5 is parallel to one side may be sufficient as a straight line, and what crosses the frame memory 7 like drawing 6 aslant is available for it.
[0015]Next, the brightness information of the pixel on the specified straight line is stored in read-out predetermined arrangement one by one from the frame memory 7 (Step S43). Next, the maximum and the minimum are calculated from the brightness information for one line stored in arrangement (Step S44). When this changes brightness information into width information at the following step, it is for deciding the threshold of binary-izing.
[0016]And brightness information is changed into width information using the maximum and the minimum which were calculated at Step S44 (Step S45). The average value of the maximum and the minimum may be sufficient as a threshold, and it may be calculated by the other methods.
[0017]Next, it is judged whether there is more width for which it asked at Step S45 than a predetermined threshold (Step S46). This judgment is for forbidding performing processing beyond it, when there is no bar code on the specified straight line. If this judgment is truth, it will go to Step S47, and if it is an imitation, it will go to step S4G.
[0018]Next, marginal check is performed (Step S47). This takes up a larger thing than the margin width beforehand defined out of the width information searched for at Step S45. When taking up, the pointer (position in a picture) of width and the number (width of what position) of width are memorized.
[0019]Next, the number of the margins which took up at Step S47 judges that it is two or more (Step S48). if the number of margins is two or more here, the barcode label 2 will be thoroughly contained into the frame memory 7 -- it carries out, and if the number of margins is one or less, from the frame memory 7, it is begun to see the barcode label 2 and it will be picturized. Therefore, although the preset value of a margin is dramatically important, this is mentioned later. If the judgment of Step S48 is truth, it will go to Step S49, and if it is an imitation, it will go to step S4A.
[0020]Next, a bar code check is performed (Step S49). This performs the easy check of whether it is the bar code information which exists between margins, when the number of margins is judged as those or more with two and a barcode label being thoroughly contained into a picture at the above-mentioned step S47. This check method is mentioned later.
[0021]Next, in Step S48, when judged with the barcode label 2 reading from the frame memory 7, and being picturized, the value of the width [minimum / in the width information searched for] is calculated (step S4A). When this determines the zoom ratio for carrying out a zoom down at the following step, it is required information.
[0022]And a zoom ratio (however, ratio of a zoom down) is determined from the information on the minimum width value calculated by step S4A (step S4B). When the judgment of Step S48 is truth, the result of the bar code check of Step S49 is judged (step

S4C). If the result of a check is truth, it will go to step S4D, and if it is an imitation, it will go to step S4G.
[0023]Next, a zoom ratio (however, ratio of zoom-in) is determined (step S4D). About this determination technique, it mentions later for details. Next, it is the arrangement zoom about the zoom ratio determined by step S4B or S4D. [i] Store (step S4E). This is for choosing the optimal thing in the zoom ratio which carried out two or more straight-line processings, and was determined respectively.
[0024]Next, it is judged whether the variable i is equal to the constant N (step S4F). This is the judgment of whether all straight-line processings of N book set up beforehand were completed. If this judgment is truth, it will go to step S4H, and if it is an imitation, it will go to step S4G.
[0025]Step S4G is processing which **********s the variable i. It goes to Step S42 after that. Next, a right zoom ratio is determined (step S4H). This is processing which chooses the thing optimal in the zoom ratio determined respectively in two or more straight-line processings, as mentioned above. Although various selection methods can be considered, what has the smallest increase in image magnification is usually chosen in N zoom-in ratios.
[0026]Finally the return of the focal distance of the lens of the optical system 3 is switched and (step S4I) carried out, and control is returned to a higher rank routine. Then, the routine of the bar code check called at Step S49 is explained, referring to the flow chart of drawing 7.
[0027]First, it is judged whether the number of the margins detected at Step S47 is larger than two (Step S491). Two things considered to be a true margin out of three or more margins if this judgment is truth are chosen (Step S492). This method is explained referring to drawing 8. Three margins are recognized in drawing 8. Two left pieces are right margins. Since the number of width was also simultaneously memorized when a margin was detected at Step S47, each margin is waiting for the width number. Here, when drawing 9 is referred to, in the upper recognition line 16, the width numbers from 0 to 10 stick, and there is 11 width information. With a lower recognition line, the width numbers from zero to 11 stick, and there is 12 width information. Then, it returns to drawing 8 and it is considered that two margins with the largest difference of a width number are true margins. In the case of drawing 8, two left pieces are clearly recognized to be a margin, and a noise (it is not related to a bar code information) like the text information 14 is removed.
[0028]Next, when the judgment of Step S491 is an imitation, the number of width between margins is counted (Step S493). (when the number of margins is two) This is processing which takes the difference of two width-of-margin numbers as mentioned above.
[0029]Next, the number of width between margins judges that it is beyond default value (Step S494). What is necessary is just to set up default value according to the kind of bar code to read here. For example, since ITF of double figures comprises 17 elements, it sets default value to 17. When this judgment is truth, it goes to Step S495, and when it is an imitation, the return of the FALSE (imitation) is carried out and control is returned to a higher rank routine.
[0030]Processing of a following series is explained with reference to drawing 9. First, it is judged whether the number of the width numbers of a left margin is even (Step S495).

If this judgment is truth, it will be judged whether the number of right width-of-margin numbers is even (Step S496). If this judgment is truth, the return of the TRUE (truth) will be carried out and control will be returned to a higher rank routine. If it is an imitation, the return of the FALSE (imitation) will be carried out and control will be returned to a higher rank routine. When the judgment of Step S495 is an imitation, it is judged whether the number of right width-of-margin numbers is odd (Step S497). If this judgment is truth, the return of the TRUE (truth) will be carried out and control will be returned to a higher rank routine. If it is an imitation, the return of the FALSE (imitation) will be carried out and control will be returned to a higher rank routine. The meaning of the above processing is explained. If the number of the width numbers of a left margin is even in order that a bar code may certainly start with a bar and may finish with a bar, a right width-of-margin number will also become even number. If the number of the width numbers of a left margin is odd, a right width-of-margin number will also become odd number. When drawing 9 is referred to, with the upper line, width-of-margin numbers are 0 and 10. With a lower line, it is 1 and 11. Thus, it can judge by Step S495, and 496 and 497 with the width information appropriate for a bar code between margins.

[0031]Then, the routine of the zoom ratio (UP) determination called by step S4D is explained, referring to the flow chart of drawing 10. first, the inside of the frame memory 7 -- the barcode label 2 -- right and left -- it judges which is approached (step S4 D1). although it understands that this has drawing 11 and drawing 12 referred to -- the barcode label 2 -- right and left -- since it may begin to see from the frame memory 7 when a zoom ratio is simply calculated only from bar code length when it inclines toward either, this judgment is needed. specifically calculate the central point of a bar code from a margin pointer on either side, and the point sees from the center of the frame memory 7 -- right and left -- it should be judged in which it is.

[0032]Next, it is judged whether the barcode label 2 inclines toward the right-hand side of the frame memory 7 (step S4 D2). If this judgment is truth, it will go to step S4 D3, and if it is an imitation, it will go to step S4 D4.

[0033]In step S4 D3 and S4 D4, with zoom, the corner point of the barcode label 2 calculates a bar code corner point and the distance based on frame memories, in order to calculate which moves the coordinates of the frame memory 7. It is because this is adjusted so that the center of a frame memory may be in agreement with the center of the optic axis of the lens of the optical system 3, so the movement magnitude of the coordinates of the corner point of the barcode label 2 is proportional to the distance from an image center.

[0034]In step S4 D5 and S4 D6, one of the corner points of the barcode label 2 calculate which can move the coordinates of the frame memory 7. First, the coordinates movable quantity 21 when the barcode label 2 inclines toward the right-hand side of the frame memory 7 is calculable from (the right end coordinates 18-required margin amount 19-bar code right end coordinates 20). With reference to drawing 11, it is the coordinates at the right end of the frame memory 7 in the right end coordinates 18, and is the quantity of the margin which needs the required margin amount 19 to decode a bar code, and the suitable value is set up here. With reference to drawing 12, the coordinates movable quantity 21 when the barcode label 2 inclines toward the left-hand side of the frame memory 7 is calculable on the contrary from (the bar code left end coordinates 22-required margin amount 19). However, the frame memory 7 is premised on a numerical

value increasing rightward [of coordinates] by left end coordinates =0 here.
[0035]Next, possible zoom magnifying power is calculated (step S4 D7). This is calculated from the movable quantity calculated by above-mentioned step S4 D3, the distance from the image center searched for by S4 D4 and above-mentioned step S4 D5, and S4 D6. What is necessary is to specifically ask with the distance x zoom magnifying power (by software, this value is known) from a coordinates movement magnitude-image center, to measure coordinates movable quantity and coordinates movement magnitude, and just to choose the zoom magnifying power (however, value than which it is less) which becomes the closest to coordinates movable quantity.
[0036]And the return of the calculated zoom ratio is carried out, and control is returned to a higher rank routine. I hear that the point which it should be careful of in the above description differs in the pixel number produced by scanning when recognizing a bar code in the straight line of N book and determining a zoom ratio, and there is. That is, in the case of drawing 5, only the length of the horizontal axis of a frame memory obtains a pixel number, but since it scans aslant in the case of drawing 6, naturally a pixel number increases more than the case of drawing 5. It does so, and asks for N zoom ratios independently, and the increase in image magnification should just choose the smallest thing.
[0037]Then, the routine of the zoom ratio (DOWN) determination called by step S4B is explained, referring to the flow chart of drawing 13. Zoom magnifying power is calculated first (step S4 B1). This calculates the value of the minimum width for which it asked by the above-mentioned step S4A by dividing it by the pixel number per one element indispensable to decode a bar code (for example, 2 pixels).
[0038]Next, proper zoom magnifying power is calculated from the calculated magnification (step S4B-2). This means that the thing nearest to calculation magnification in the existing zoom magnifying power is chosen, and there is.
[0039]Although the above-mentioned step S47 explained marginal check, setting out of a margin is dramatically difficult. It is because the value of the margin set up in a specific distance stops working effectively when the distance of the barcode label 2 and a bar code reader changes a lot. That is, when the distance of the barcode label 2 and a bar code reader is too near, the label has overflowed the frame memory 7 and the value of (referring to drawing 16) and a margin is too small, there is a danger of mistaking a 1 bar code [1] element for a margin. Conversely, if the value of a margin is too large, the field which can decode a bar code will be narrowed. What gives the ranging information on the autofocus part 9 to the auto zoom part 10 in the composition of drawing 1 as a method of solving this, and makes a margin the function of distance can be considered. For example, there is a method to which distance and the value of a margin are made inversely proportional like drawing 14. However, if both are made thoroughly in inverse proportion, when the distance of the barcode label 2 and a bar code reader will change also 10 times, a margin will also change 10 times, a margin will become so large for a short distance, and a reading range will become narrow. It is made therefore, better [for a margin to usually change only in a certain range scale like drawing 15].
[0040]Since this method recognizes bar code size, without actually decoding a bar code and determines a zoom ratio, processing is completed dramatically for a short time, but. When the brightness information of one line is incorporated at Step S43 and it stores in arrangement to contract time furthermore, it is every other, i.e., the method of thinning

out and storing, piece, without storing no brightness information. In this case, it having to take care is having to make the value of a margin, the value of the breadth of the frame memory 7, etc. into a half (when thinning out two pieces, it is 1/3).
[0041]When there are N steps of zoom, there is a problem where to put a default position (position which a lens will move there if a power supply is switched on), but if it usually places in the middle of N stage, the lens by zoom-in down is promptly movable. However, depending on application, the default is put on the maximum wide angle side (state which carried out the zoom down most), and the method of carrying out only zoom-in is also considered. In this case, step S4A and S4B become unnecessary and there is a merit that processing simplifies.
[0042]In the embodiment mentioned above, although the example of the one-dimensional bar code was explained, it can apply also like two-dimensional bar codes, such as PDF417, the code 49, Maxi code, QR Code, and Data Matrix code, for example, without being limited to it.
[0043]
[Effect of the Invention]Since it has an automatic-focusing switching arrangement which detects a bar code in one arbitrary straight line of the frame memory as a memory array, and moves the lens position of an optical system according to the size according to this invention as explained above, Even when the bar code of various sizes must be read even if the distance of a barcode label and a bar code reader changes or, a bar code can be read at high speed and certainly. That is, the range which can be read becomes large and user-friendliness improves. Since complicated processing like conventional two-dimensional Image Processing Division is not performed and it can process at high speed using a cheap processing unit (processor), a cheap reader is realizable.

TECHNICAL FIELD

[Field of the Invention]This invention relates to the bar code reader which has an automatic-focusing range selection device.

PRIOR ART

[Description of the Prior Art]In recent years, many things which use solid state image pickup devices (for example, CCD, CMD, etc.) as a device which reads optical information (mainly bar code) have come to be used. The CCD-type device has an advantage of unlike a laser type, it not depending in the direction of a bar code which can read the two-dimensional bar code announced in recent years, but being able to decode.
[0003]It is also possible to change the focal distance of a lens and to change image magnification by moving a lens minutely using an actuator etc., from the place where the composition of a device (optical system) is similar to the commercial miniature camera. If this technique is used, in the imaging range of CCD, a bar code symbol will be too large, and will have overflowed, or (Refer to drawing 16), Conversely, when it cannot read by being too small (refer to drawing 17), image magnification can be changed without changing the distance of a bar code and a reader, and a bar code symbol can be picturized and decoded in a suitable size to an object image (frame memory).
[0004]As a symbol information reader which has such an automatic-focusing range

selection device conventionally, a reader which is indicated by the US,5,331,176,B Description, for example is known. In this device, the lens position was adjusted and the symbol is decoded so that a square two-dimensional symbol may be included in the frame made from Lighting Sub-Division by software processing.

EFFECT OF THE INVENTION

[Effect of the Invention]As explained above, in this invention, a bar code is detected in one arbitrary straight line of the frame memory as a memory array, and it has an automatic-focusing switching arrangement which moves the lens position of an optical system according to the size.
Therefore, even when the bar code of various sizes must be read even if the distance of a barcode label and a bar code reader changes or, a bar code can be read at high speed and certainly.
That is, the range which can be read becomes large and user-friendliness improves. Since complicated processing like conventional two-dimensional Image Processing Division is not performed and it can process at high speed using a cheap processing unit (processor), a cheap reader is realizable.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, in order to perform software data processing to a two-dimensional picture (frame memory) for a short time, expensive processing units (CPU, DSP, etc.) were needed at high speed, and SUBJECT that the price of the device itself will become high occurred.
[0006]Then, the purpose of this invention solves such conventional SUBJECT, and there is in providing the bar code reader which has an automatic-focusing range selection device which can further be processed [that it is cheap and] in a short time.

MEANS

[Means for Solving the Problem]In order to solve said SUBJECT, a bar code reader of this invention, In a bar code reader which has an automatic-focusing means for switching which switches automatically a focal distance of a memory array which memorizes a bar code picturized by solid imaging means through an optical system, and a bar code and a device main frame, Said automatic-focusing range selection means recognizes a bar code symbol from brightness information of said memory array, and determines a focal distance change ratio according to a size of a bar code, and performing a focal distance change has the feature. It has the feature that said especially brightness information is information on one arbitrary straight line of a memory array.
[0008]
[Embodiment of the Invention]Hereafter, Drawings explain an embodiment of the invention in detail. Drawing 1 is a lineblock diagram of the bar code reader in which an embodiment of the invention is shown, and drawing 2 is an outline flowchart of the bar code reader of drawing 1.
[0009]This bar code reader consists of the optical system 3, CCD4, the infrared ray

emitting device (henceforth IR) 5, the photosensor diode (henceforth PSD) 6, the frame memory 7 as a memory array, CPU8, the controller 12, and the lens actuator 13. CPU8 comprises the autofocus part 9, the auto zoom part 10, and the decode part 11.
[0010]First, perform initial setting (Step S1), emit light in infrared rays from IR5, and the catoptric light is detected by PSD6, It calculates in the autofocus part 9 in CPU8, the distance to a bar code reader and the barcode label 2 is measured (Step S2), a control signal is taken out to the controller 12 and the lens actuator 13 according to the result, and the focal position of the optical system 3 is adjusted. The bar code image whose focus suited will be picturized by the frame memory 7 by this the processing of a series of (Step S3).
[0011]Next, image formation of the barcode label 2 printed or stuck on the load 1 is carried out to CCD4 by the optical system 3. The label information by which photoelectric conversion was carried out is incorporated into the frame memory 7 as a video signal. If the information on the picture on the frame memory 7 is sent to the auto zoom part 10, the processing according to a picture will be made, a control signal will be again taken out to the controller 12 and the lens actuator 13 according to the result, and the focal distance of the optical system 3 will be adjusted. The barcode label 2 will be picturized by the frame memory 7 in the optimal size by this the processing of a series of (step S4).
[0012]And in the decode part 11, the decipherment based on a predetermined bar code decipherment algorithm for the barcode label 2 picturized in the optimal size is performed, and is outputted to the host device etc. which are not illustrated (Step S5).
[0013]The flow chart is written into this Description according to the recording mode of programming language C. Then, the auto zoom of step S4 in drawing 2 is explained, referring to the flow chart of drawing 3 and drawing 4.
[0014]First, the variable i is initialized to 1 (Step S41). Next, the arbitrary straight lines which carry out the virtual scan of the frame memory 7 are determined (Step S42). The operation which stores in read-out predetermined arrangement the brightness information of the pixel which a virtual scan has on the straight line one by one from the frame memory 7 is said here. In Step S42, the coordinates of a linear both-ends point may be sufficient as a linear specification method, and a slope of a line and a section may be sufficient as it. use any -- the straight line of N book is prepared beforehand (for example, the coordinates of N group are beforehand put into arrangement). Of course, what of the frame memory 7 like drawing 5 is parallel to one side may be sufficient as a straight line, and what crosses the frame memory 7 like drawing 6 aslant is available for it.
[0015]Next, the brightness information of the pixel on the specified straight line is stored in read-out predetermined arrangement one by one from the frame memory 7 (Step S43). Next, the maximum and the minimum are calculated from the brightness information for one line stored in arrangement (Step S44). When this changes brightness information into width information at the following step, it is for deciding the threshold of binary-izing.
[0016]And brightness information is changed into width information using the maximum and the minimum which were calculated at Step S44 (Step S45). The average value of the maximum and the minimum may be sufficient as a threshold, and it may be calculated by the other methods.
[0017]Next, it is judged whether there is more width for which it asked at Step S45 than a predetermined threshold (Step S46). This judgment is for forbidding performing

processing beyond it, when there is no bar code on the specified straight line. If this judgment is truth, it will go to Step S47, and if it is an imitation, it will go to step S4G.
[0018]Next, marginal check is performed (Step S47). This takes up a larger thing than the margin width beforehand defined out of the width information searched for at Step S45. When taking up, the pointer (position in a picture) of width and the number (width of what position) of width are memorized.
[0019]Next, the number of the margins which took up at Step S47 judges that it is two or more (Step S48). if the number of margins is two or more here, the barcode label 2 will be thoroughly contained into the frame memory 7 -- it carries out, and if the number of margins is one or less, from the frame memory 7, it is begun to see the barcode label 2 and it will be picturized. Therefore, although the preset value of a margin is dramatically important, this is mentioned later. If the judgment of Step S48 is truth, it will go to Step S49, and if it is an imitation, it will go to step S4A.
[0020]Next, a bar code check is performed (Step S49). This performs the easy check of whether it is the bar code information which exists between margins, when the number of margins is judged as those or more with two and a barcode label being thoroughly contained into a picture at the above-mentioned step S47. This check method is mentioned later.
[0021]Next, in Step S48, when judged with the barcode label 2 reading from the frame memory 7, and being picturized, the value of the width [minimum / in the width information searched for] is calculated (step S4A). When this determines the zoom ratio for carrying out a zoom down at the following step, it is required information.
[0022]And a zoom ratio (however, ratio of a zoom down) is determined from the information on the minimum width value calculated by step S4A (step S4B). When the judgment of Step S48 is truth, the result of the bar code check of Step S49 is judged (step S4C). If the result of a check is truth, it will go to step S4D, and if it is an imitation, it will go to step S4G.
[0023]Next, a zoom ratio (however, ratio of zoom-in) is determined (step S4D). About this determination technique, it mentions later for details. Next, it is the arrangement zoom about the zoom ratio determined by step S4B or S4D. [i] Store (step S4E). This is for choosing the optimal thing in the zoom ratio which carried out two or more straight-line processings, and was determined respectively.
[0024]Next, it is judged whether the variable i is equal to the constant N (step S4F). This is the judgment of whether all straight-line processings of N book set up beforehand were completed. If this judgment is truth, it will go to step S4H, and if it is an imitation, it will go to step S4G.
[0025]Step S4G is processing which **********s the variable i. It goes to Step S42 after that. Next, a right zoom ratio is determined (step S4H). This is processing which chooses the thing optimal in the zoom ratio determined respectively in two or more straight-line processings, as mentioned above. Although various selection methods can be considered, what has the smallest increase in image magnification is usually chosen in N zoom-in ratios.
[0026]Finally the return of the focal distance of the lens of the optical system 3 is switched and (step S4I) carried out, and control is returned to a higher rank routine. Then, the routine of the bar code check called at Step S49 is explained, referring to the flow chart of drawing 7.

[0027]First, it is judged whether the number of the margins detected at Step S47 is larger than two (Step S491). Two things considered to be a true margin out of three or more margins if this judgment is truth are chosen (Step S492). This method is explained referring to drawing 8. Three margins are recognized in drawing 8. Two left pieces are right margins. Since the number of width was also simultaneously memorized when a margin was detected at Step S47, each margin is waiting for the width number. Here, when drawing 9 is referred to, in the upper recognition line 16, the width numbers from 0 to 10 stick, and there is 11 width information. With a lower recognition line, the width numbers from zero to 11 stick, and there is 12 width information. Then, it returns to drawing 8 and it is considered that two margins with the largest difference of a width number are true margins. In the case of drawing 8, two left pieces are clearly recognized to be a margin, and a noise (it is not related to a bar code information) like the text information 14 is removed.

[0028]Next, when the judgment of Step S491 is an imitation, the number of width between margins is counted (Step S493). (when the number of margins is two) This is processing which takes the difference of two width-of-margin numbers as mentioned above.

[0029]Next, the number of width between margins judges that it is beyond default value (Step S494). What is necessary is just to set up default value according to the kind of bar code to read here. For example, since ITF of double figures comprises 17 elements, it sets default value to 17. When this judgment is truth, it goes to Step S495, and when it is an imitation, the return of the FALSE (imitation) is carried out and control is returned to a higher rank routine.

[0030]Processing of a following series is explained with reference to drawing 9. First, it is judged whether the number of the width numbers of a left margin is even (Step S495). If this judgment is truth, it will be judged whether the number of right width-of-margin numbers is even (Step S496). If this judgment is truth, the return of the TRUE (truth) will be carried out and control will be returned to a higher rank routine. If it is an imitation, the return of the FALSE (imitation) will be carried out and control will be returned to a higher rank routine. When the judgment of Step S495 is an imitation, it is judged whether the number of right width-of-margin numbers is odd (Step S497). If this judgment is truth, the return of the TRUE (truth) will be carried out and control will be returned to a higher rank routine. If it is an imitation, the return of the FALSE (imitation) will be carried out and control will be returned to a higher rank routine. The meaning of the above processing is explained. If the number of the width numbers of a left margin is even in order that a bar code may certainly start with a bar and may finish with a bar, a right width-of-margin number will also become even number. If the number of the width numbers of a left margin is odd, a right width-of-margin number will also become odd number. When drawing 9 is referred to, with the upper line, width-of-margin numbers are 0 and 10. With a lower line, it is 1 and 11. Thus, it can judge by Step S495, and 496 and 497 with the width information appropriate for a bar code between margins.

[0031]Then, the routine of the zoom ratio (UP) determination called by step S4D is explained, referring to the flow chart of drawing 10. first, the inside of the frame memory 7 -- the barcode label 2 -- right and left -- it judges which is approached (step S4 D1). although it understands that this has drawing 11 and drawing 12 referred to -- the barcode label 2 -- right and left -- since it may begin to see from the frame memory 7 when a

zoom ratio is simply calculated only from bar code length when it inclines toward either, this judgment is needed. specifically calculate the central point of a bar code from a margin pointer on either side, and the point sees from the center of the frame memory 7 -- right and left -- it should be judged in which it is.

[0032]Next, it is judged whether the barcode label 2 inclines toward the right-hand side of the frame memory 7 (step S4 D2). If this judgment is truth, it will go to step S4 D3, and if it is an imitation, it will go to step S4 D4.

[0033]In step S4 D3 and S4 D4, with zoom, the corner point of the barcode label 2 calculates a bar code corner point and the distance based on frame memories, in order to calculate which moves the coordinates of the frame memory 7. It is because this is adjusted so that the center of a frame memory may be in agreement with the center of the optic axis of the lens of the optical system 3, so the movement magnitude of the coordinates of the corner point of the barcode label 2 is proportional to the distance from an image center.

[0034]In step S4 D5 and S4 D6, one of the corner points of the barcode label 2 calculate which can move the coordinates of the frame memory 7. First, the coordinates movable quantity 21 when the barcode label 2 inclines toward the right-hand side of the frame memory 7 is calculable from (the right end coordinates 18-required margin amount 19-bar code right end coordinates 20). With reference to drawing 11, it is the coordinates at the right end of the frame memory 7 in the right end coordinates 18, and is the quantity of the margin which needs the required margin amount 19 to decode a bar code, and the suitable value is set up here. With reference to drawing 12, the coordinates movable quantity 21 when the barcode label 2 inclines toward the left-hand side of the frame memory 7 is calculable on the contrary from (the bar code left end coordinates 22-required margin amount 19). However, the frame memory 7 is premised on a numerical value increasing rightward [of coordinates] by left end coordinates =0 here.

[0035]Next, possible zoom magnifying power is calculated (step S4 D7). This is calculated from the movable quantity calculated by above-mentioned step S4 D3, the distance from the image center searched for by S4 D4 and above-mentioned step S4 D5, and S4 D6. What is necessary is to specifically ask with the distance x zoom magnifying power (by software, this value is known) from a coordinates movement magnitude-image center, to measure coordinates movable quantity and coordinates movement magnitude, and just to choose the zoom magnifying power (however, value than which it is less) which becomes the closest to coordinates movable quantity.

[0036]And the return of the calculated zoom ratio is carried out, and control is returned to a higher rank routine. I hear that the point which it should be careful of in the above description differs in the pixel number produced by scanning when recognizing a bar code in the straight line of N book and determining a zoom ratio, and there is. That is, in the case of drawing 5, only the length of the horizontal axis of a frame memory obtains a pixel number, but since it scans aslant in the case of drawing 6, naturally a pixel number increases more than the case of drawing 5. It does so, and asks for N zoom ratios independently, and the increase in image magnification should just choose the smallest thing.

[0037]Then, the routine of the zoom ratio (DOWN) determination called by step S4B is explained, referring to the flow chart of drawing 13. Zoom magnifying power is calculated first (step S4 B1). This calculates the value of the minimum width for which it

asked by the above-mentioned step S4A by dividing it by the pixel number per one element indispensable to decode a bar code (for example, 2 pixels).
[0038]Next, proper zoom magnifying power is calculated from the calculated magnification (step S4B-2). This means that the thing nearest to calculation magnification in the existing zoom magnifying power is chosen, and there is.
[0039]Although the above-mentioned step S47 explained marginal check, setting out of a margin is dramatically difficult. It is because the value of the margin set up in a specific distance stops working effectively when the distance of the barcode label 2 and a bar code reader changes a lot. That is, when the distance of the barcode label 2 and a bar code reader is too near, the label has overflowed the frame memory 7 and the value of (referring to drawing 16) and a margin is too small, there is a danger of mistaking a 1 bar code [1] element for a margin. Conversely, if the value of a margin is too large, the field which can decode a bar code will be narrowed. What gives the ranging information on the autofocus part 9 to the auto zoom part 10 in the composition of drawing 1 as a method of solving this, and makes a margin the function of distance can be considered. For example, there is a method to which distance and the value of a margin are made inversely proportional like drawing 14. However, if both are made thoroughly in inverse proportion, when the distance of the barcode label 2 and a bar code reader will change also 10 times, a margin will also change 10 times, a margin will become so large for a short distance, and a reading range will become narrow. It is made therefore, better [for a margin to usually change only in a certain range scale like drawing 15].
[0040]Since this method recognizes bar code size, without actually decoding a bar code and determines a zoom ratio, processing is completed dramatically for a short time, but. When the brightness information of one line is incorporated at Step S43 and it stores in arrangement to contract time furthermore, it is every other, i.e., the method of thinning out and storing, piece, without storing no brightness information. In this case, it having to take care is having to make the value of a margin, the value of the breadth of the frame memory 7, etc. into a half (when thinning out two pieces, it is 1/3).
[0041]When there are N steps of zoom, there is a problem where to put a default position (position which a lens will move there if a power supply is switched on), but if it usually places in the middle of N stage, the lens by zoom-in down is promptly movable. However, depending on application, the default is put on the maximum wide angle side (state which carried out the zoom down most), and the method of carrying out only zoom-in is also considered. In this case, step S4A and S4B become unnecessary and there is a merit that processing simplifies.
[0042]In the embodiment mentioned above, although the example of the one-dimensional bar code was explained, it can apply also like two-dimensional bar codes, such as PDF417, the code 49, Maxi code, QR Code, and Data Matrix code, for example, without being limited to it.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a lineblock diagram of the bar code reader in which an embodiment of the invention is shown.
[Drawing 2]It is a flow chart for explaining rough operation of the bar code reader of

drawing 1.
[Drawing 3]It is a flow chart for explaining the auto zoom of drawing 2.
[Drawing 4]It is a flow chart for explaining the auto zoom of drawing 2.
[Drawing 5]It is a figure explaining signs that the bar code in a frame memory is recognized by two or more lines.
[Drawing 6]It is the figure which illustrated the example of setting out of two or more lines as a variation of drawing 5.
[Drawing 7]It is a flow chart for explaining the bar code check in drawing 3.
[Drawing 8]It is a figure explaining signs that a barcode label and text information are intermingled in a frame memory.
[Drawing 9]It is a figure explaining the method of the bar code check.
[Drawing 10]It is a flow chart for explaining the zoom ratio (UP) determination in drawing 3.
[Drawing 11]A bar code is the figure which inclines toward the right.
[Drawing 12]A bar code is the figure which inclines toward the left.
[Drawing 13]It is a flow chart for explaining the zoom ratio (DOWN) determination in drawing 3.
[Drawing 14]It is a figure explaining signs that the value of a margin changes with ranging information.
[Drawing 15]It is the figure which illustrated the related example of a margin and distance information as a variation of drawing 7.
[Drawing 16]A barcode label is a figure explaining signs that the frame memory is protruded.
[Drawing 17]A barcode label is the figure which illustrated signs that it was too small, to the frame memory.
[Description of Notations]
1 Load
2 Barcode label
3 Optical system
4 CCD
5 Infrared ray emitting device
6 Photosensor diode
7 Frame memory
8 CPU
9 Autofocus part
10 Auto zoom part
11 Day code section
12 Controller
13 Lens actuator